CLAIMS

1. A method of preparing a substrate, said method comprising:

exposing the substrate with a plurality of images, each of the plurality of images having a different orientation with respect to a crystal axis of the substrate; and

anisotropically etching the substrate to form a plurality of alignment markers, a location of at least a portion of each of the plurality of alignment markers substantially coinciding with a location of a corresponding portion of a corresponding one of the plurality of images,

wherein the orientation of each of the plurality of images is within four degrees of the orientation of each other one of the plurality of images.

2. The method of preparing a substrate according to claim 1, wherein a distance between the orientations of each pair among the plurality of images is within the range of from ($5x10^{-6}$) degrees to four degrees.

3. The method of preparing a substrate according to claim 1, wherein the orientation of at least one of the plurality of images is within the range of from 0.5 degrees to 2 degrees on one side of a nominal orientation of the crystal axis, and

wherein the orientation of at least one of the plurality of images is within the range of from 0.5 degrees to 2 degrees on the other side of a nominal orientation of the crystal axis.

4. The method of preparing a substrate according to claim 1, said method further comprising:

measuring a position of each of the plurality of alignment markers; and

determining an orientation of the crystal axis based on the measured positions.

5. The method of preparing a substrate according to claim 4, said method further comprising marking, on at least one of the substrate and another substrate cut from the same crystal, information indicative of the determined orientation.

6. The method of preparing a substrate according to claim 1, wherein at least one of the plurality of alignment markers includes features selected from the group consisting of gratings, chevrons, and boxes.

7. The method of preparing a substrate according to claim 1, wherein at least one of the plurality of alignment markers comprises at least one area having a plurality of small elements on a contrasting background.

8. A method of preparing a substrate comprising:

providing on a surface of the substrate a plurality of alignment markers, each of said plurality of alignment markers having a different orientation relative to a crystal axis of the substrate,

wherein, for each of said plurality of alignment markers, a distance between an apparent position of the marker and an actual position of an element of the marker is dependent on the orientation of the marker.

9. The method of preparing a substrate according to claim 8, wherein a distance between the orientations of each pair among the plurality of alignment markers is within the range of from ($5x10^{-6}$) degrees to 4 degrees.

10. The method of preparing a substrate according to claim 8, wherein the orientation of at least one of the plurality of alignment markers is within the range of from 0.5 degrees to 2 degrees on one side of a nominal orientation of the crystal axis, and

wherein the orientation of at least one of the plurality of alignment markers is within the range of from 0.5 degrees to 2 degrees on the other side of a nominal orientation of the crystal axis.

11. The method of preparing a substrate according to claim 8, wherein providing said alignment markers comprises using an anisotropic etching process to etch said alignment markers into the substrate.

12. A method of determining an orientation of a crystal axis of a substrate, the substrate having provided thereon a plurality of alignment markers, a feature of each of the plurality of alignment markers having a predetermined position, each of the plurality of alignment markers having a different orientation relative to a crystal axis of the substrate, said method comprising:

measuring a position of each among the plurality of alignment markers;

determining deviations of the measured positions from the corresponding predetermined positions; and

determining the orientation of the crystal axis relative to the plurality of alignment markers from the deviations.

13. The method of determining an orientation of a crystal axis of a substrate according to claim 12, wherein said measuring a position of each among the plurality of alignment markers includes determining a center of gravity in at least one dimension for at least one of the plurality of alignment marks.

14. The method of determining an orientation of a crystal axis of a substrate according to claim 12, said method further comprising marking, on at least one among the substrate and another substrate cut from the same crystal, information indicative of the determined orientation.

15. The method of determining an orientation of a crystal axis of a substrate according to claim 12, said method further comprising storing information relating to the determined orientation in a database.

16. A device manufacturing method, said method comprising:

providing a beam of radiation;

patterning the beam; and

projecting the patterned beam onto a target portion of a layer of radiation-sensitive material that at least partially covers a substrate,

wherein said projecting includes controlling an orientation of at least one of the substrate and the projected pattern relative to the other, and

wherein said controlling is based on information indicative of an orientation of a crystal axis of the substrate, said information having been determined from a plurality of alignment markers on one among the substrate and another substrate cut from the same crystal.

17. The device manufacturing method according to claim 16, wherein a feature of each of the plurality of alignment markers has a predetermined position, and

wherein each of the plurality of alignment markers has a different orientation relative to the crystal axis of the substrate

18. The device manufacturing method according to claim 16, wherein said projecting includes projecting the patterned beam onto a first side of the substrate,

said method further comprising providing on a second side of the substrate the plurality of alignment markers, a feature of each of the plurality of alignment markers having a predetermined position, each of the plurality of alignment markers having a different orientation relative to the crystal axis of the substrate.

19. The device manufacturing method according to claim 16, wherein said controlling is based on information indicative of an orientation of a crystal axis of the substrate, said information having been determined from another substrate cut from the same crystal as the substrate.

20. The device manufacturing method according to claim 16, wherein at least one of the plurality of alignment markers includes features selected from the group consisting of gratings, groups of gratings, chevrons, and boxes.

21. The device manufacturing method according to claim 16, wherein at least one of the plurality of alignment markers comprises at least one area having a plurality of small elements on a contrasting background.

22. A lithographic apparatus comprising:

an illumination system configured to provide a projection beam of radiation;

a patterning structure configured to pattern the projection beam according to a desired pattern;

a substrate table configured to hold a substrate;

a projection system configured to project the patterned beam onto a target portion of the substrate; and

a control system configured to control an orientation of at least one of the substrate and the projected pattern relative to the other based on information indicative of an orientation of a crystal axis of the substrate, said information having been determined from a plurality of alignment markers on one among the substrate and another substrate cut from the same crystal.

23. The lithographic apparatus according to claim 22, further comprising an alignment system configured to measure positions of alignment markers on the substrate.

24. The lithographic apparatus according to claim 23, wherein the alignment system is configured to measure a center of gravity of an alignment marker on the substrate.

25. A data storage medium having machine-readable information including a set of instructions defining a method of determining an orientation of a crystal axis of a substrate, the substrate having provided thereon a plurality of alignment markers, a feature of each of the plurality of alignment markers having a predetermined position, each of the plurality of alignment markers having a different orientation relative to a crystal axis of the substrate, said method comprising:

measuring a position of each among the plurality of alignment markers;

determining deviations of the measured positions from the corresponding predetermined positions; and

determining the orientation of the crystal axis relative to the plurality of alignment markers from the deviations.

26. A substrate comprising a plurality of alignment markers, each of said plurality of alignment markers having a different orientation with respect to a crystal axis of the substrate,

wherein the orientation of each of the plurality of alignment markers is within four degrees of the orientation of each other one of the plurality of alignment markers, and

wherein, for each of the plurality of alignment markers, a distance between a moment of the alignment marker and a feature of the alignment marker depends on the orientation of the alignment marker.

27. The substrate according to claim 26, wherein, for at least one of the plurality of alignment markers, a distance between a center of gravity of the alignment marker and a feature of the alignment marker depends on the orientation of the alignment marker.

28. A substrate having thereon a plurality of alignment markers at respective predetermined positions, each of the plurality of alignment markers having a different orientation relative to a crystal axis of said substrate, and a form of each of the plurality of alignment markers being such that an apparent position of the alignment marker is dependent on the orientation of the alignment marker.